CLAIMS

WHAT IS CLAIMED:

1. A method, comprising:

providing a library of optical characteristic traces, each of which corresponds to a grating structure comprised of a plurality of features having a known profile;

forming a plurality of grating structures in a layer of photoresist, each of said formed grating structures being comprised of a plurality of features having an unknown profile;

illuminating said formed grating structures;

measuring light reflected off of each of said plurality of formed grating structures to generate an optical characteristic trace for each of said plurality of formed grating structures;

comparing each of said generated optical characteristic traces to at least one optical characteristic trace from said library; and

modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer based upon said comparison of said generated optical characteristic traces and said at least one optical characteristic trace from said library.

2. The method of claim 1, wherein said plurality of formed grating structures are formed within an area defined by a single exposure field of a stepper exposure process.

3. The method of claim 1, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least three grating structures in a layer of photoresist.

4. The method of claim 1, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist.

5. The method of claim 1, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist.

6. The method of claim 1, wherein modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer comprises modifying at least one of a focal plane position, a tilt angle of a reticle, and a tilt angle of a wafer for at least one subsequently processed wafer.

7. The method of claim 1, wherein said formed grating structures are comprised of a plurality of lines or trenches.

8. The method of claim 1, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

9. The method of claim 1, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

10. A method, comprising:

providing a library of optical characteristic traces, each of which corresponds to a grating structure comprised of a plurality of features having a known profile;

forming a plurality of grating structures in a layer of photoresist within an area defined by a single exposure field of a stepper exposure process, each of said formed grating structures being comprised of a plurality of features having an unknown profile;

illuminating said formed grating structures;

measuring light reflected off of each of said plurality of formed grating structures to generate an optical characteristic trace for each of said plurality of formed grating structures;

comparing each of said generated optical characteristic traces to at least one optical characteristic trace from said library; and

modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer based upon said comparison of said generated optical characteristic traces and said at least one optical characteristic trace from said library.

11. The method of claim 10, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least three grating structures in a layer of photoresist.

12. The method of claim 10, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist.

13. The method of claim 10, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist.

14. The method of claim 10, wherein modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer comprises modifying at least one of a focal plane position, tilt angle of a reticle, and tilt angle of a wafer for at least one subsequently processed wafer.

15. The method of claim 10, wherein said formed grating structures are comprised of a plurality of lines or trenches.

16. The method of claim 10, wherein said exposure field is defined by a top edge, a bottom edge, a plurality of side edges and four corners.

17. The method of claim 16, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least three grating structures in a layer of photoresist, one of said grating structures being positioned proximate said top edge of said exposure field, and each of two of said grating structures being positioned adjacent a corner adjacent said bottom edge of said exposure field.

18. The method of claim 16, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist, one of said grating structures being positioned at approximately a middle of said exposure field, and each of four of said grating structures being positioned proximate a corner of said exposure field.

19. The method of claim 16, wherein forming a plurality of grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist, eight of said grating structures being positioned around a perimeter of said exposure field, and one of said grating structures being positioned at approximately a middle of said exposure field.

20. The method of claim 10, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

21. The method of claim 10, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

22. A method, comprising:

providing a library of optical characteristic traces, each of which corresponds to a grating structure comprised of a plurality of features having a known profile;

forming at least three grating structures in a layer of photoresist within an area defined by a single exposure field of a stepper exposure process, each of said formed grating structures being comprised of a plurality of features having an unknown profile, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners;

illuminating said formed grating structures;

measuring light reflected off of each of said at least three formed grating structures to generate an optical characteristic trace for each of said at least three formed grating structures;

comparing each of said generated optical characteristic traces to at least one optical characteristic trace from said library; and

modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer based upon said comparison of said generated optical characteristic traces and said at least one optical characteristic trace from said library.

23. The method of claim 22, wherein forming at least three grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist.

24. The method of claim 22, wherein forming at least three grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist.

25. The method of claim 22, wherein modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer

comprises modifying at least one of a focal plane position, tilt angle of a reticle, and tilt angle of a wafer for at least one subsequently processed wafer.

26. The method of claim 22, wherein said at least three formed grating structures are comprised of a plurality of lines or trenches.

27. The method of claim 22, wherein forming at least three grating structures in a layer of photoresist comprises forming at least three grating structures in a layer of photoresist, one of said grating structures being positioned proximate said top edge of said exposure field, and each of two of said grating structures being positioned adjacent a corner adjacent said bottom edge of said exposure field.

28. The method of claim 22, wherein forming at least three grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist, one of said grating structures being positioned at approximately a middle of said exposure field, and each of four of said grating structures being positioned proximate a corner of said exposure field.

29. The method of claim 22, wherein forming at least three grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist, eight of said grating structures being positioned around a perimeter of said exposure field, and one of said grating structures being positioned at approximately a middle of said exposure field.

30. The method of claim 22, wherein measuring light reflected off of said at least three grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

31. The method of claim 22, wherein measuring light reflected off of said at least three grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

32. A method, comprising:

providing a library of optical characteristic traces, each of which corresponds to a grating structure comprised of a plurality of features having a known profile;

forming at least four grating structures in a layer of photoresist within an area defined by a single exposure field of a stepper exposure process, each of said formed grating structures being comprised of a plurality of features having an unknown profile, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners;

illuminating said formed grating structures;

measuring light reflected off of each of said at least four formed grating structures to generate an optical characteristic trace for each of said plurality of formed grating structures;

comparing each of said generated optical characteristic traces to at least one optical characteristic trace from said library; and

modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer based upon said comparison of said

generated optical characteristic traces and said at least one optical characteristic trace from said library.

33. The method of claim 32, wherein forming at least four grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist.

34. The method of claim 32, wherein forming at least four grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist.

35. The method of claim 32, wherein modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer comprises modifying at least one of a focal plane position, a tilt angle of a reticle, and a tilt angle of a wafer for at least one subsequently processed wafer.

36. The method of claim 32, wherein said formed grating structures are comprised of a plurality of lines or trenches.

37. The method of claim 32, wherein each of said at least four grating structures are positioned proximate a corner of said exposure field.

38. The method of claim 32, wherein forming at least four grating structures in a layer of photoresist comprises forming at least five grating structures in a layer of photoresist, one of said grating structures being positioned at approximately a middle of said exposure

field, and each of four of said grating structures being positioned proximate a corner of said exposure field.

39. The method of claim 32, wherein forming at least four grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist, eight of said grating structures being positioned around a perimeter of said exposure field, and one of said grating structures being positioned at approximately a middle of said exposure field.

40. The method of claim 32, wherein measuring light reflected off of said at least four grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

41. The method of claim 32, wherein measuring light reflected off of said at least four grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

42. A method, comprising:

providing a library of optical characteristic traces, each of which corresponds to a grating structure comprised of a plurality of features having a known profile;

forming at least four grating structures in a layer of photoresist within an area defined by a single exposure field of a stepper exposure process, each of said formed grating structures being comprised of a plurality of features having an unknown profile, said exposure field being defined by a top edge, a bottom

edge, a plurality of side edges and four corners, each of four of said grating structures being positioned proximate a corner of said exposure field;

illuminating said formed grating structures;

measuring light reflected off of each of said plurality of formed grating structures to generate an optical characteristic trace for each of said plurality of formed grating structures;

comparing each of said generated optical characteristic traces to at least one optical characteristic trace from said library; and

modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer based upon said comparison of said generated optical characteristic traces and said at least one optical characteristic trace from said library.

43. The method of claim 42, wherein forming at least four grating structures in a layer of photoresist comprises forming at least nine grating structures in a layer of photoresist.

44. The method of claim 42, wherein modifying at least one parameter of a stepper exposure process to be performed on at least one subsequently processed wafer comprises modifying at least one of a focal plane position, a tilt angle of a reticle, and a tilt angle of a wafer for at least one subsequently processed wafer.

45. The method of claim 42, wherein said formed grating structures are comprised of a plurality of lines or trenches.

46. The method of claim 42, further comprising forming at least five additional grating structures in said layer of photoresist within said single exposure field, each of four of said at least five additional grating structures being positioned proximate a middle of at least one of said top edge, said bottom edge and said plurality of side edges of said exposure field, and one of said at least five additional grating structures being positioned proximate a middle of said exposure field.

47. The method of claim 42, wherein measuring light reflected off of said at least four grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

48. The method of claim 42, wherein measuring light reflected off of said at least four grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

49. A method, comprising:

providing a wafer having at least one process layer and a layer of photoresist formed thereabove;

forming a plurality of grating structures in said layer of photoresist;

illuminating said formed grating structures;

measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures;

comparing the generated optical characteristic trace for each of said formed grating structures to a target optical characteristic trace; and

determining, based upon a comparison of said generated optical characteristic trace and said target optical characteristic trace, at least one parameter of an exposure process to be performed on a layer of photoresist formed above a subsequently processed wafer.

50. The method of claim 49, wherein providing a wafer having at least one process layer and a layer of photoresist formed thereabove comprises providing a wafer having at least one process layer and a layer of photoresist formed thereabove, said layer of photoresist being comprised of either a negative or positive photoresist material.

51. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least three grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process.

52. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises performing an exposure process in a stepper tool to form a plurality of grating structures in said layer of photoresist.

53. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least three grating structures in said layer of photoresist.

54. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least five grating structures in said layer of photoresist.

55. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist

56. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least three grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners, at least two of said grating structures being formed in separate corners of said exposure field.

57. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least three grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners, each of at least two of said grating structures being formed adjacent one of said corners proximate said bottom edge of said exposure field, and at least one of said grating structures being formed adjacent said top edge of said exposure field.

58. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least four grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and

four corners, each of said grating structures being formed adjacent one of said corners of said exposure field.

59. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least five grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners, each of four of said grating structures being formed adjacent one of said corners of said exposure field, and at least one of said grating structures being formed proximate a middle of said exposure field.

60. The method of claim 49, wherein forming a plurality of grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners, at least three of said grating structures being formed proximate each of said top edge, bottom edge and plurality of side edges of said exposure field.

61. The method of claim 49, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

62. The method of claim 49, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

63. The method of claim 49, further comprising modifying, based upon a comparison of said generated optical characteristic traces and said target optical characteristic trace, at least one parameter of an exposure process to be performed on a layer of photoresist formed on a subsequently processed wafer.

64. The method of claim 49, wherein said at least one parameter of said exposure process is comprised of at least one of a location of a focal plane position, a tilt angle of a reticle and a tilt angle of a wafer for at least one subsequently processed wafer.

65. The method of claim 49, wherein measuring the reflected light comprises measuring the intensity of the reflected light.

66. A method, comprising:

providing a wafer having at least one process layer and a layer of photoresist formed thereabove;

forming at least three grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners;

illuminating said formed grating structures;

measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures;

comparing the generated optical characteristic trace for each of said grating structures to a target optical characteristic trace; and

modifying, based upon a comparison of said generated optical characteristic traces and said target optical characteristic trace, at least one parameter of an exposure process to be performed on a layer of photoresist formed on a subsequently processed wafer.

67. The method of claim 66, wherein providing a wafer having at least one process layer and a layer of photoresist formed thereabove comprises providing a wafer having at least one process layer and a layer of photoresist formed thereabove, said layer of photoresist being comprised of either a negative or positive photoresist material.

68. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises performing an exposure process in a stepper tool to form at least three grating structures in said layer of photoresist.

69. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises forming at least five grating structures in said layer of photoresist.

70. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist

71. The method of claim 66, wherein each of at least two of said grating structures are formed adjacent one of said corners proximate said bottom edge of said exposure field, and at least one of said grating structures is formed adjacent said top edge of said exposure field.

72. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises forming at least four grating structures in said layer of photoresist, each of said grating structures being formed adjacent one of said corners of said exposure field.

73. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises forming at least five grating structures in said layer of photoresist, each of four of said grating structures being formed adjacent one of said corners of said exposure field, and at least one of said grating structures being formed proximate a middle of said exposure field.

74. The method of claim 66, wherein forming at least three grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist, at least three of said grating structures being formed proximate each of said top edge, bottom edge and plurality of side edges of said exposure field.

75. The method of claim 66, wherein measuring light reflected off of said formed structures to generate an optical characteristic trace for each of said grating structures is

performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

76. The method of claim 66, wherein measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

77. The method of claim 66, wherein said at least one parameter of said exposure process is comprised of at least one of a location of a focal plane position, a tilt angle of a reticle and a tilt angle of a wafer for at least one subsequently processed wafer.

78. The method of claim 66, wherein measuring the reflected light comprises measuring the intensity of the reflected light.

79. A method, comprising:

providing a wafer having at least one process layer and a layer of photoresist formed thereabove;

forming at least four grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners, each of said grating structures being formed adjacent one of said corners of said exposure field;

illuminating said formed grating structures;

measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures;

comparing the generated optical characteristic trace for each of said grating structures to a target optical characteristic trace; and

modifying, based upon a comparison of said generated optical characteristic traces and said target optical characteristic trace, at least one parameter of an exposure process to be performed on a layer of photoresist formed on a subsequently processed wafer.

80. The method of claim 79, wherein providing a wafer having at least one process layer and a layer of photoresist formed thereabove comprises providing a wafer having at least one process layer and a layer of photoresist formed thereabove, said layer of photoresist being comprised of either a negative or positive photoresist material.

81. The method of claim 79, wherein forming at least four grating structures in said layer of photoresist comprises performing an exposure process in a stepper tool to form at least four grating structures in said layer of photoresist.

82. The method of claim 79, wherein forming at least four grating structures in said layer of photoresist comprises forming at least five grating structures in said layer of photoresist.

83. The method of claim 79, wherein forming at least four grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist

84. The method of claim 79, further comprising forming an additional grating structure in said layer of photoresist proximate a middle of said exposure field.

85. The method of claim 79, wherein forming at least four grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist, at least three of said grating structures being formed proximate each of said top edge, bottom edge and plurality of side edges of said exposure field.

86. The method of claim 79, wherein measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

87. The method of claim 79, wherein measuring light reflected off of said plurality of grating structures to generate an optical characteristic trace for each of said grating structures is performed after said layer of photoresist is subjected to a development process.

88. The method of claim 79, wherein said at least one parameter of said exposure process is comprised of at least one of a location of a focal plane position, a tilt angle of a reticle and a tilt angle of a wafer for at least one subsequently processed wafer.

89. The method of claim 79, wherein measuring the reflected light comprises measuring the intensity of the reflected light.

90. A method, comprising:

providing a wafer having at least one process layer and a layer of photoresist formed thereabove;

forming at least four grating structures in said layer of photoresist within an area defined by a single exposure field of a stepper exposure process, said exposure field being defined by a top edge, a bottom edge, a plurality of side edges and four corners;

illuminating said formed grating structures, each of said grating structures being formed adjacent one of said corners of said exposure field, and at least one of said grating structures being formed proximate a middle of said exposure field;

measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures;

comparing the generated optical characteristic trace for each of said grating structures to a target optical characteristic trace; and

modifying, based upon a comparison of said generated optical characteristic traces and said target optical characteristic trace, at least one parameter of an exposure process to be performed on a layer of photoresist formed on a subsequently processed wafer.

91. The method of claim 90, wherein providing a wafer having at least one process layer and a layer of photoresist formed thereabove comprises providing a wafer having at least one process layer and a layer of photoresist formed thereabove, said layer of photoresist being comprised of either a negative or positive photoresist material.

92. The method of claim 90, wherein forming at least four grating structures in said layer of photoresist comprises performing an exposure process in a stepper tool to form at least five grating structures in said layer of photoresist.

93. The method of claim 90, wherein forming at least five grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist

94. The method of claim 90, wherein forming at least five grating structures in said layer of photoresist comprises forming at least nine grating structures in said layer of photoresist, at least three of said grating structures being formed proximate each of said top edge, bottom edge and plurality of side edges of said exposure field.

95. The method of claim 90, wherein measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures is performed after said layer of photoresist has been subjected to a post-exposure bake process and prior to said layer of photoresist being subjected to a development process.

96. The method of claim 90, wherein measuring light reflected off of said formed grating structures to generate an optical characteristic trace for each of said formed grating structures is performed after said layer of photoresist is subjected to a development process.

97. The method of claim 90, wherein said at least one parameter of said exposure process is comprised of at least one of a location of a focal plane position, a tilt angle of a reticle and a tilt angle of a wafer for at least one subsequently processed wafer.

98. The method of claim 90, wherein measuring the reflected light comprises measuring the intensity of the reflected light.